Methyl Isobutyl Ketone

COPC: **Methyl isobutyl ketone** CAS 108-10-1

Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Oral (gavage)
Test Endpoint: NOAEL
Reference: Microbiological Associates 1986 (Obtained from Health Effects Assessment Summary Table (HEAST; EPA, 1993) as cited in Toxicological Benchmarks for Wildlife. ES/ER/TM-86/R1.
QCE: 250 mg/kg-day Assumed a body weight of 0.315 kg.

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	No exposures during critical stages.
Q_1	1	1	1	Ecologically relevant endpoint (liver and kidney function)
Q_2	1	1	1	Chronic study (13-weeks)
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Exposure was subchronic
Total AF	4	8	12	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	250	250	250	QCE = quantified critical endpoint
TRV	63	31	21	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	63	Test organism is in the same order and trophic level as the functional group members	none
2	31	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	21	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Nickel

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Chicken (Omnivore, Order-Galliformes)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Weber, C.W., and Reid, B.L., 1968, *Nickel toxicity in growing chicks,* J. Nutr. 95:612-616.

QCE: 37 mg/kg-day—500 ppm in diet converted to a dose using an estimated ingestion rate* of 0.037 kg/day and a body weight of 500 g from the study.

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Subchronic toxicity studies with adequate numbers of animals
Q_1	1	1	1	Production parameters (growth)
Q_2	2	2	2	Subchronic study
Q_3	1	1	1	NOAEL endpoint
U	3	3	3	Older study, reproductive endpoints not evaluated
Total AF	6	12	18	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	37	37	37	QCE = quantified critical endpoint
TRV	6.2	3.1	2.1	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	6.2	Test organism is in the same order and trophic level as the functional group members	none
2	3.1	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	2.1	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

*Estimated as 0.0582 $Wt^{0.651}$ (kg) as cited in EPA, 1993. Wildlife Exposure Factors Handbook.

COPC: **Nickel** CAS 7440-02-0
(nickel carbonate)

Test Organisms: Bovine (Herbivore, Order-Artiodactyla)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: O'Dell et al., 1970a, "Effect of Nickel Supplementation on the Production and composition of Milk, *J. Dairy Science.* National Academy of Sciences, 1980, *Mineral Tolerance of Domestic Animals,* Washington, DC.

QCE: 4.1 mg/kg-day—1835mg/day/450 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level
				R = 2 is AF for different order and same trophic level
				R = 3 is AF for different order and trophic level
I	3	3	3	Secondary source
Q_1	1	1	1	Growth and food intake
Q_2	2	2	2	Subchronic study
Q_3	1	1	1	NOAEL endpoint
U	3	3	3	Limited information or supporting studies.
Total AF	18	36	54	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	4.1	4.1	4.1	QCE = quantified critical endpoint
TRV	0.23	0.11	0.08	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.23	Test organism is in the same order and trophic level as the functional group members	none
2	0.11	Test organism is in a different order and same trophic level from the functional group members	M121, M122, M122A, M123, M132
3	0.08	Test organism is in a different order and trophic level from the functional group members	M210, M210A, M222, M322, M422, M422A

*BW an estimate until get actual article

**Other O'Dell articles may be more helpful, check the NAS book.

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Mallard Duck

Exposure Medium: Oral in diet

Test Endpoint: NOAEL

Reference: Cain, B.W. and E.A. Pafford, 1981, "Effects of Dietary Nickel on Survival and Growth of Mallard Duckling", *Arch. Environm. Contam. Toxicol.* 10, 737-745.

QCE: 200 ppm

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	36 ducklings divided into 6 cages with 6 birds per cage (3 male 3 female). 12 birds were given a dose of either 200, 800, or 1200 ppm.
Q_1	1	1	1	Development endpoints measured (body weight, bill length, humerus, heart, liver, gizzard, kidneys).
Q_2	1	1	1	Chronic study (60-90 days)
Q_3	1	1	1	NOAEL
U	1	1	1	Good supporting references.
Total AF	2	4	6	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	200	200	200	QCE = quantified critical endpoint
TRV	100	50	33	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	100	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	50	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	33	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Dog (Omnivore, Order-Carnivora)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Ambrose, A.M. et al. 1976, *Long-Term Toxicologic Assessment of Nickel in Rats and Dogs*, J. Food Sci. Technol. 13:181-187.

QCE: 25 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Chronic toxicity study with adequate numbers of animals
Q_1	1	1	1	Body weight gain
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Limited information or supporting studies.
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	25	25	25	QCE = quantified critical endpoint
TRV	13	6.3	4.2	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	13	Test organism is in the same order and trophic level as the functional group members	M422A
2	6.3	Test organism is in a different order and same trophic level from the functional group members	M422
3	4.2	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M123, M210, M210A, M222, M322

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Mallard (Herbivore, Order-Anseriformes)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Eastin, W.C., Jr. and O'Shea, T.J., 1981, *Effects of Dietary Nickel on Mallards,* J. Toxicol. Environ. Health 7(6):883-892.

White, D.H., and M.P. Dieter, 1978, *Effects of Dietary Vanadium in Mallard Ducks,* Journal of Toxicol. and Environ. Health, 4:43-50.

QCE: 140 mg/kg-day—(800mg/kg food)*(0.205mg/day*)/1.17 kg BW **

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level
				R = 2 is AF for different order and same trophic level
				R = 3 is AF for different order and trophic level
I	2	2	2	Subchronic toxicity study; variability not addressed
Q_1	1	1	1	Egg production, hatchability, duckling survival; hematological parameters
Q_2	2	2	2	Subchronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Reproductive endpoints evaluated, no LOAEL identified.
Total AF	8	16	24	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	140	140	140	QCE = quantified critical endpoint
TRV	17.5	8.75	5.83	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	17.5	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	8.75	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	5.83	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

*Birds on 800ppm diet ate 15% more food than the 178g/day of the controls = 205g

**Body weight is indicated in the 1978 White and Dieter study.

COPC: **Nickel** CAS 7440-02-0

Test Organisms: Rat (Omnivore, Order-Rodentia)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Ambrose, A.M., et al., 1976 *Long-Term Toxicologic Assessment of Nickel in Rats and Dogs,* J. Food Sci. Technol. 13:181-187.

ABC (American Biogenics Corp.), 1986, *Ninety-Day Gavage Study in Albino Rats Using Nickel,* Draft Final Report submitted to Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709.

RTI (Research Triangle Institute), 1987, *Two Generation Reproduction and Fertility Study of Nickel Chloride Administered to CD Rats in Drinking Water: Fertility and Reproductive Performance of the Po Generation (Part II of III) and F1 Generation (Part III of III),* Final study report, Report submitted to Office of Solid Waste Management, U.S. EPA, Washington, DC.

QCE: 5 mg/kg-day—Specified

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Chronic toxicity study with adequate numbers of animals.
Q_1	1	1	1	Body weight gain
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Low survival in controls; however, another study by ABC, 1986 supports the 5 mg/kg/day NOAEL. A NOAEL for reproductive effects in a study by RTI (1987) was higher than the Ambrose study.
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	5	5	5	QCE = quantified critical endpoint
TRV	2.5	1.3	0.83	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	2.5	Test organism is in the same order and trophic level as the functional group members	none
2	1.3	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.83	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

PCBs (Aroclor 1254)

COPC:	**PCBs (Aroclor 1254)** CAS 11097-69-1
Test Organisms:	Pheasant (*Phasianus colchicus,* Omnivore, Order-Galliformes)
Exposure Medium:	Gelatin capsule with corn oil
Test Endpoint:	LOAEL
Reference:	Dahlgren, R.B., R.L. Linder, and C.W. Carlson, 1972, *Polychlorinated Biphenyls: Their Effects on Penned Pheasants,* Environmental Health Perspectives, 1:89-101.
QCE:	1.8 mg/kg-day—12.5 mg/wk for 16 weeks; assumed BW of 1 kg (Wildlife Exposure Factors Handbook (EPA, 1993))

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Results presented in this paper are from 1970 and 1971 study. The 1970 part was reported in Dahlgren and Linder (1971). Two groups of 5 cocks each were given weekly gelatin capsule with control or 25 mg PCB. Hens (30 in 1970 and 34 in 1971) were given weekly a gelatin capsule with either 12.5 or 50 mg PCB. Some differences seen from 1st to 2nd year.
Q_1	1	1	1	# eggs laid, egg fertility, hatchability, eggshell thickness, and chick behavior, weight and survival. Ecologically relevant endpoint
Q_2	1	1	1	Chronic duration (16 weeks)
Q_3	2	2	2	LOAEL endpoint
U	2	2	2	Very thorough study that looks at ecologically relevant endpoints (relatively insensitive neuro. endpoints). Bolus dosing method might result in less absorption than daily exposure and exposure subchronic to adults only; however, effects noted were slight and variable, and dose-response varied from one year to the next, however, lowest dose (at which response was seen) was used. No NOAEL established.
Total AF	8	16	24	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	1.8	1.8	1.8	QCE = quantified critical endpoint
TRV	0.23	0.11	0.08	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.23	Test organism is in the same order and trophic level as the functional group members	none
2	0.11	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
3	0.08	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

Dahlgren, R.B., and R.L. Linder, 1971, *Effects of Polychlorinated Biphenyls on Pheasant Reproduction, Behavior, and Survival,* Journal of Wildlife Management, 35(2):315-319

COPC: **PCBs (Aroclor 1254)** CAS 11097-69-1

Test Organisms: Rat (Omnivore, Order-Rodentia)

Exposure Medium: Diet in chow

Test Endpoint: NOAEL

Reference: Linder, R.E., T.B. Gaines, and R.D. Kimbrough, 1974, *The Effect of Polychlorinated Biphenyls on Rat Reproduction,* Food and Cosmetic Toxicology, 12:63-77.

QCE: 0.32 mg/kg-day—Specified

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Well-designed long-term study
Q_1	1	1	1	Liver weights, # of litter, litter size, and survival of young. Ecologically relevant endpoints
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	1	1	1	Thorough, well-designed and analyzed, relevant study. Multiple doses examined at different generations.
Total AF	1	2	3	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.32	0.32	0.32	QCE = quantified critical endpoint
TRV	0.32	0.16	0.11	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.32	Test organism is in the same order and trophic level as the functional group members	none
2	0.16	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.11	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Phenol

COPC: **Phenol** CAS 108-95-2

Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Oral in water
Test Endpoint: NOAEL
Reference: NTP, 1983, *Teratologic Evaluation of Phenol in CD Rats and Mice.* Report prepared by Research Triangle Institute, Research Triangle Park, NC. NTIS PB83-247726, Gov. Rep. Announce Index 83(25):6247.
QCE: 60 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Low variability because similar studies exhibited no effects at a dose rate on order of magnitude higher that the NOAEL
Q_1	1	1	1	Ecologically relevant endpoint (reduced fetal body weight).
Q_2	3	3	3	Acute (9 days)
Q_3	1	1	1	NOAEL
U	1	1	1	High quality studies with four dose levels and during a critical life stage (gestation).
M	0.5	0.5	0.5	Placed in drinking water
Total AF	1.5	3	4.5	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	60	60	60	QCE = quantified critical endpoint
TRV	40	20	13	Toxicity Reference Value = QCE/Total AF

Appropriate Functional Groups:

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	40	Test organism is in the same order and trophic level as the functional group members	none
2	20	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	13	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Pyrene

COPC: **Pyrene** CAS 129-00-0

Test Organisms: Mouse (Omnivore, Order-Rodentia)
Exposure Medium: Oral in diet
Test Endpoint: NOAEL
Reference: EPA, 1989, *Mouse Oral Subchronic Toxicity of Pyrene.* Study conducted by Toxicity Research Laboratories, Muskegon, MI for the Office of Solid Waste, Washington DC.
QCE: 75 mg/kg/day (Specified)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Relatively small group sizes, variability not addressed
Q_1	0.5	0.5	0.5	Although endpoint could occur in ROC, the ecological relevance is questionable since kidney lesions were mild.
Q_2	1	1	1	Chronic study (13 weeks)
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	No reproductive endpoints examined
Total AF	2	4	6	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	75	75	75	QCE = quantified critical endpoint
TRV	38	19	13	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	38	Test organism is in the same order and trophic level as the functional group members	none
2	19	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	13	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Selenium (Sodium selenite)

COPC: **Selenium (Sodium selenite)** CAS 7782-49-2

Test Organisms: Chicken (Omnivore, Order-Galliformes)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Ort, J.F. and J.D. Latshaw, 1978, "The toxic level of sodium selenite in the diet of laying chickens," Journal of Nutrition, 108:1114-1120.

EPA, 1993, Ch. 9. Selenium Effects at Kesterson Reservoir, A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective, EPA/630/R-92/005.

Eisler, R. 1985, Selenium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, U.S. Fish and Wildlife Service, Biological Report, 85(1.5).

QCE: 0.198 mg/kg-day—(3mg/kg)*(0.132kg/hen-day**)/2kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Adequate numbers tested (100 female birds) and results are consistent with other studies in chickens and quail
Q_1	1	1	1	Endpoint ecologically relevant: egg production, egg weight and fertility, hatchability
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	2	2	2	Older study but good design, however only females were tested
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.198	0.198	0.198	QCE = quantified critical endpoint
TRV	0.099	0.050	0.033	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.099	Test organism is in the same order and trophic level as the functional group members	none
2	0.050	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	0.033	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

**Ingestion rate specified in table 2 page 1116 of article

COPC: **Selenium (Sodium selenite)** CAS 7782-49-2

Test Organisms: Mallard (Herbivore, Order-Anseriformes)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Heinz, G.H. et al. 1987, "Reproduction in mallards fed selenium," Environmental Toxicology and Chemistry, 6:423-433.

Eisler, R. 1985, Selenium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, U.S. Fish and Wildlife Service, Biological Report, 85(1.5).

EPA. 1993, Ch. 9. Selenium Effects at Kesterson Reservoir, A Review of Ecological Assessment Case Studies from a Risk Assessment Perspective, EPA/630/R-92/005.

QCE: 0.5 mg/kg-day—(5 mg/kg * 0.1 kg feed)/ 1 kg bird

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	10 pairs for five doses tested, study results consistent with other studies in chickens and quail, repro/devel. toxicity analysis only.
Q_1	1	1	1	Ecologically relevant endpoint (egg hatchability)
Q_2	1	1	1	Chronic study (2-4 mos.)
Q_3	1	1	1	NOAEL endpoint
U	1	1	1	Reproductive study only with different forms of selenium
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.5	0.5	0.5	QCE = quantified critical endpoint
TRV	0.25	0.13	0.08	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.25	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	0.13	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	0.08	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

Selenium

COPC: **Selenium** CAS 7782-49-2
Test Organisms: Rat (Omnivore, Order-Rodentia)
Exposure Medium: Diet
Test Endpoint: NOAEL
Reference: Rosenfeld, I. and O.A. Beath. 1954. Effect of selenium on reproduction in rats. Proc. Soc. Exp. Biol. Med. 87:295-297.
QCE: 0.075 mg/kg-day—Specified

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Chronic toxicity studies with adequate numbers of animals
Q_1	1	1	1	Ecologically relevant endpoint (reproduction, number of young reared)
Q_2	1	1	1	Chronic study
Q_3	1	1	1	NOAEL endpoint
U	1	1	1	Older study, but analyzed 5 breeding cycles and 2 generations. A more recent study by Nobunaga et al. (1979) reports a NOAEL of 390 ug/kg/day selenite for mice reproductive success.
Total AF	1	2	3	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.075	0.075	0.075	QCE = quantified critical endpoint
TRV	0.075	0.038	0.025	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.075	Test organism is in the same order and trophic level as the functional group members	none
2	0.038	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.025	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **Selenium** CAS 7782-49-2

Test Organisms: Mouse (Omnivore, Order-Rodentia)

Exposure Medium: Oral in water

Test Endpoint: FEL

Reference: Schroeder and Mitchner 1971. Toxic effects of trace elements on the reproduction of mice and rats. *Arch. Environ. Health.* 23: 102-106.

QCE: 0.76 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Adequate numbers of females (104) tested, no males or juveniles tested.
Q_1	1	1	1	Ecologically relevant endpoint (reproduction, number of young reared)
Q_2	1	1	1	Chronic study (3 generations)
Q_3	3	3	3	FEL endpoint (only one dose examined)
U	2	2	2	Good design, only reproductive endpoints (fetus) examined.
M	0.5	0.5	0.5	Placed in drinking water.
Total AF	6	12	18	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.76	0.76	0.76	QCE = quantified critical endpoint
TRV	0.13	0.06	0.04	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.13	Test organism is in the same order and trophic level as the functional group members	none
2	0.06	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.04	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

*ingestion rate and BW specified in article

COPC: **Selenium** CAS 7782-49-2

Test Organisms: Sheep (Herbivore, Order-Artiodactyla)

Exposure Medium: Diet

Test Endpoint: FEL

Reference: Eisler, R. 1985, Selenium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, U.S. Fish and Wildlife Service, Biological Report, 85(1.5).

QCE: 3.2 mg/kg-day—Specified

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level
				R = 2 is AF for different order and same trophic level
				R = 3 is AF for different order and trophic level
I	3	3	3	Secondary source
Q_1	1	1	1	Ecologically relevant endpoint (mortality)
Q_2	3	3	3	Acute study
Q_3	3	3	3	FEL - Lethal endpoint
U	3	3	3	Secondary source
Total AF	81	162	243	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	3.2	3.2	3.2	QCE = quantified critical endpoint
TRV	0.04	0.02	0.01	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.04	Test organism is in the same order and trophic level as the functional group members	none
2	0.02	Test organism is in a different order and same trophic level from the functional group members	M121, M122, M122A, M123, M132
3	0.01	Test organism is in a different order and trophic level from the functional group members	M210, M210A, M222, M322, M422, M422A

COPC: **Selenium** CAS 7782-49-2

Test Organisms: Black-crowned Night Heron

Exposure Medium: Diet

Test Endpoint: LOAEL

Reference: Smith, G.J., et al., 1988, "Reproduction in Black-Crowned Night-Herons Fed Selenium." *Lake and Reservoir Mgmt.* 4(2):175-180.

QCE: 2.5 mg/kg-day—10 mg/kg in diet converted to dose by multiplying by 0.212 kg/day ingestion rate and dividing by 0.85 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Adequate numbers of males and females tested (12 pairs), study results consistent with other studies in chickens and quails.
Q_1	1	1	1	Hatching success, organ weights, blood measures, eggshell thickness, however 3-day-old hatchlings had shorter femurs and radius ulna legs and other hematological effects.
Q_2	1	1	1	Chronic study
Q_3	2	2	2	LOAEL
U	2	2	2	No NOAEL established. Reproductive endpoints examined.
Total AF	8	16	24	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	2.5	2.5	2.5	QCE = quantified critical endpoint
TRV	0.31	0.16	0.10	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.31	Test organism is in the same order and trophic level as the functional group members	none
2	0.16	Test organism is in a different order and same trophic level from the functional group members	AV310, AV322, AV322A, AV333, AV342
3	0.10	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222AAV232, AV233, AV241, AV242, AV432, AV432A, AV442

Silver

COPC: **Silver** CAS 7440-22-4

Test Organisms: Mouse (Omnivore, Order-Rodentia)

Exposure Medium: Drinking Water

Test Endpoint: FEL

Reference: Rungby and Danscher, 1984, "Hypoactivity in silver exposed mice," Acta Pharmacol and Toxicol, 55(5):398-401.

QCE: 3.0 mg/kg-day—(0.09 mg/ 0.03 kg)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level
				R = 2 is AF for different order and same trophic level
				R = 3 is AF for different order and trophic level
I	2	2	2	Females only for the long-term study
Q_1	0.1	0.1	0.1	Not clearly relevant endpoint
Q_2	2	2	2	Subchronic duration
Q_3	3	3	3	FEL
U	2	2	2	Only one dose, no NOAEL identified.
M	0.5	0.5	0.5	Placed in drinking water
Total AF	1.2	2.4	3.6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	3	3	3	QCE = quantified critical endpoint
TRV	2.5	1.3	0.8	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	2.5	Test organism is in the same order and trophic level as the functional group members	none
2	1.3	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.8	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Thallium

COPC: **Thallium** CAS 7440-28-0

Test Organisms: Quail (Omnivore, Order-Galliformes)

Exposure Medium: Oral in diet (bread)

Test Endpoint: FEL

Reference: Shaw, P.A., 1933, "Toxicity and deposition of thallium in certain game birds," Journal of Pharmacology and Experimental Therapeutics, 48(4):478-487.

QCE: 12 mg/kg

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	Very old study, doses and effects poorly characterized, only high doses and lethal endpoints considered
Q_1	1	1	1	Ecologically relevant endpoint (lethality)
Q_2	3	3	3	Acute duration
Q_3	3	3	3	FEL for lethality
U	3	3	3	Very old study, poorly designed and analyzed
Total AF	81	162	243	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	12	12	12	QCE = quantified critical endpoint
TRV	0.15	0.07	0.05	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.15	Test organism is in the same order and trophic level as the functional group members	none
2	0.07	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	0.05	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

*Ingestion rate from Wildlife Exposure Factors Handbook and BW from Weimeyer article

**note-in the article the units on the 12 were just mg/kg...it was assumed that that meant kg of food.

COPC: **Thallium** CAS 7440-28-0

Test Organisms: Rat (Omnivore, Order-Rodentia)

Exposure Medium: Oral in Diet

Test Endpoint: LOAEL—Hair loss

Reference: Downs, W., Scott, J., Steadman, L., Maynard, E., 1960, "Acute and Sub-acute Toxicity Studies of Thallium Compounds", *Industrial Hygiene Journal*, pp. 399-406.

QCE: 1.8mg/kg-day—Specified (Average between 1-3 depending on the BW)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Smaller number of male and female rats tested, no juveniles tested.
Q_1	1	1	1	Ecologically relevant endpoint
Q_2	2	2	2	Subchronic duration
Q_3	2	2	2	LOAEL
U	2	2	2	Good design, a variety of compounds tested, reproductive endpoints not examined. Compound is thallium acetate. Similar responsiveness for thallium oxide.
Total AF	16	32	48	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	1.8	1.8	1.8	QCE = quantified critical endpoint
TRV	0.11	0.06	0.04	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.11	Test organism is in the same order and trophic level as the functional group members	none
2	0.06	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.04	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC:	**Thallium** CAS 7440-28-0
Test Organisms:	Rat (Omnivore, Order-Rodentia)
Exposure Medium:	Drinking Water
Test Endpoint:	FEL Reduced sperm motility, etc.
Reference:	Formigli, L., et al., 1986, "Thallium-induced testicular toxicity in the rat," Environmental Research, 40(2):531-539.
QCE:	0.75mg/kg-day—Daily intake of 0.27 mg/rat, each rat weighing an avg. of 0.35 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Well characterized effects, consistent results among groups, only male reproduction toxicity was evaluated.
Q_1	1	1	1	Ecologically relevant endpoint
Q_2	2	2	2	Subchronic duration
Q_3	3	3	3	FEL based on reproductive effects
U	2	2	2	Only one dose, no NOAEL identified
M	0.5	0.5	0.5	Placed in drinking water
Total AF	6	12	18	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	0.75	0.75	0.75	QCE = quantified critical endpoint
TRV	0.13	0.06	0.04	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.13	Test organism is in the same order and trophic level as the functional group members	none
2	0.06	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.04	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Vanadium (Vanadyl sulfate)

COPC: **Vanadium (Vanadyl sulfate)** CAS 27774-13-6

Test Organisms: Chicken (Omnivore, Order-Galliformes)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Kubena, L.F. and T.D. Phillips, 1982, "Toxicity of vanadium in female leghorn chickens," Poultry Science, 62:47-50.

QCE: 1.7 mg/kg-day—25 ppm in diet converted to dose using an estimated 0.1 kg/day ingestion rate and 1.5 kg BW as indicated in study

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	Subchronic study with adequate numbers of animals
Q_1	1	1	1	Endpoint ecologically relevant (growth and egg production)
Q_2	2	2	2	Subchronic duration
Q_3	1	1	1	NOAEL
U	2	2	2	Multiple doses evaluated, good statistical analysis of data, but only weight and egg production were evaluated.
Total AF	4	8	12	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	1.7	1.7	1.7	QCE = quantified critical endpoint
TRV	0.43	0.21	0.14	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.43	Test organism is in the same order and trophic level as the functional group members	none
2	0.21	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	0.14	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

**FI=0.0582(BW)0.651 cited in EPA Wildlife Exposures Handbook

COPC: **Vanadium (Vanadyl sulfate)** CAS 27774-13-6

Test Organisms: Mallard (Herbivore, Order-Anseriformes)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: White, D.H. and M.P. Dieter, 1978, "Effects of dietary vanadium in mallard ducks. Journal of Toxicology and Environmental Health.

QCE: 1.0 mg/kg-day—10 ppm in diet converted to dose using 0.121 kg/day ingestion rate and 1.17 kg BW as indicated in study.

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Subchronic study with adequate numbers of animals
Q_1	0.5	0.5	0.5	Ecological relevance of endpoint questionable (altered lipid metabolism)
Q_2	2	2	2	Subchronic duration
Q_3	1	1	1	NOAEL
U	2	2	2	No reproductive endpoint evaluated, multiple doses evaluated
Total AF	4	8	12	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	1.0	1.0	1.0	QCE = quantified critical endpoint
TRV	0.25	0.13	0.08	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.25	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	0.13	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	0.08	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

COPC: **Vanadium (Vanadyl sulfate)** CAS 27774-13-6

Test Organisms: Mouse (Omnivore, Order-Rodentia)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Schroeder, H.A. and J.J. Balassa, 1967, "Arsenic, germanium, tin and vanadium in mice: Effects on growth, survival and tissue levels," Journal of Nutrition, 92:245-252.

ATSDR. Agency for Toxic Substance Disease Registry. 1990. Draft: Toxicological Profile for Vanadium. October, 1990.

QCE: 4.1 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	1	1	1	108 males and females tested
Q_1	1	1	1	Ecologically relevant endpoint (body weight gain)
Q_2	1	1	1	Chronic duration
Q_3	1	1	1	NOAEL
U	3	3	3	Older study, reproductive endpoints and sensitive life stage not examined,. Only one dose was tested, no LOAEL found.
Total AF	3	6	9	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	4.1	4.1	4.1	QCE = quantified critical endpoint
TRV	1.37	0.68	0.46	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	1.37	Test organism is in the same order and trophic level as the functional group members	none
2	0.68	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.46	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Vanadium (Ammonium metavanadate)

COPC: **Vanadium** (Ammonium metavanadate) CAS 7803-55-6

Test Organisms: Bovine (calves)

Exposure Medium: Gelatin capsule

Test Endpoint: NOAEL—Clinical symptoms

Reference: Platonow, N. and H.K. Abbey, 1968, "Toxicity of Vanadium in Calves". *Vet. Record,* 82:292.

QCE: 7.5 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	10 young males
Q_1	1	1	1	Ecologically relevant endpoint.
Q_2	2	2	2	Subchronic duration
Q_3	1	1	1	NOAEL
U	2	2	2	Older study, reproductive and sensitive endpoints not evaluated.
Total AF	8	16	24	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	7.5	7.5	7.5	QCE = quantified critical endpoint
TRV	0.94	0.47	0.31	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.94	Test organism is in the same order and trophic level as the functional group members	none
2	0.47	Test organism is in a different order and same trophic level from the functional group members	M121, M122, M122A, M123, M132
3	0.31	Test organism is in a different order and trophic level from the functional group members	M210, M210A, M222, M322, M422, M422A

Xylene

COPC: **Xylene** CAS 1330-20-7

Test Organisms: Mouse (Omnivore, Order-Rodentia)

Exposure Medium: Oral (gavage)

Test Endpoint: NOAEL

Reference: Marks, T., Ledoux, T., and Moore, J., 1982, "Teratogenicity of a Commercial Xylene Mixture in the Mouse", *J Toxi. Environ. Health*, 9:97.

QCE: 2.06 mg/kg-day—Specified

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Only females during gestation given the doses, no males or juveniles tested.
Q_1	1	1	1	Ecologically relevant endpoint (mortality/histopathologic effects)
Q_2	2	2	2	Subchronic exposure for pups (days 6-15 of gestation)
Q_3	1	1	1	NOAEL
U	2	2	2	Well designed study, 3 replicates done, sensitive life stage and reproductive endpoint tested but pup neurotox. and neurodevelopment are probably more sensitive endpoints.
Total AF	8	16	24	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	2.06	2.06	2.06	QCE = quantified critical endpoint
TRV	0.258	0.129	0.086	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	0.258	Test organism is in the same order and trophic level as the functional group members	none
2	0.129	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	0.086	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

COPC: **Xylene** CAS 1330-20-7

Test Organisms: Rat (Omnivore, Order-Rodentia)

Exposure Medium: Oral (gavage)

Test Endpoint: NOAEL

Reference: National Toxicology Program (NTP), 1986, *NTP Technical Report on the Toxicology and Carcinogenesis of Xylene (Mixed) (60.2% m-Xylene, 13.6% p-Xylene, 17.0% Ethylbenzene, and 9.1%o-Xylene) (CAS No. 1330-20-7) in F344N/N Rates and B6C3F1 Mice (Gavage Studies),* NIH Publication No. 86-2583, Research Triangle Park, N.C.

QCE: 250 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Adult males and females tested. No juveniles tested.
Q_1	1	1	1	Ecologically relevant endpoint (mortality/histopathologic effects)
Q_2	1	1	1	Chronic (103-week) exposure
Q_3	1	1	1	NOAEL
U	2	2	2	Well-designed study with adequate numbers of animals from two species tested. Comprehensive histology was performed. A LOAEL was not determined.
Total AF	4	8	12	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	250	250	250	QCE = quantified critical endpoint
TRV	62.5	31.3	20.8	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	62.5	Test organism is in the same order and trophic level as the functional group members	none
2	31.3	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	20.8	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322

Zinc (zinc sulfate)

COPC: **Zinc (zinc sulfate)** CAS 68813-94-5

Test Organisms: Chicken (Omnivore, Order-Galliformes)

Exposure Medium: Diet

Test Endpoint: LOAEL

Reference: Stahl, J.L., Greger, J.L., and M.E. Cook, 1990, "Breeding hen and progeny when hens are fed excessive dietary zinc," Poultry Science, 69:259-263.

Hoadley, J.E., S.H. Tao, and M.R. W. Fox, 1989, "Dietary cadmium and zinc effects on peripheral neuromuscular development," 73rd Annual Meeting of the Federation of American Societies for Experimental Biology, New Orleans, LA., March 19-23, 1989, Federation of American Society for Experimental Biology, 4929.

QCE: 12 mg/kg-day—20 mg/kg in diet converted to dose by 0.105 kg/day ingestion (from study) and 0.172 kg BW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level
				R = 2 is AF for different order and same trophic level
				R = 3 is AF for different order and trophic level
I	1	1	1	Chronic study with adequate number of animals
Q_1	1	1	1	Endpoint ecologically relevant (egg production)
Q_2	1	1	1	Chronic duration
Q_3	2	2	2	LOAEL
U	1	1	1	High quality study
Total AF	2	4	6	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	12	12	12	QCE = quantified critical endpoint
TRV	6.0	3.0	2.0	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	6.0	Test organism is in the same order and trophic level as the functional group members	none
2	3.0	Test organism is in a different order and same trophic level from the functional group members	AV422, AV432, AV433,AV442
3	2.0	Test organism is in a different order and trophic level from the functional group members	AV121, AV122, AV132, AV142, AV143, AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342

Zinc

COPC: **Zinc** CAS 7440-66-6

Test Organisms: Ferret (Carnivore, Order-Carnivora)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Straube, E.F., Schuster, N.H., and Sinclair, A.J., 1980, "Zinc toxicity in the ferret," Journal of Comparative Pathology, 90:355-361.

QCE: 142 mg/kg-day—500mg/kg*0.170kg/day/0.60kgBW

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	3	3	3	NOAEL group was only 3 animals
Q_1	1	1	1	Overall health, weight gain, hematological measurements, levels of zinc in organs
Q_2	2	2	2	Subchronic duration (48, 138 and 191 days)
Q_3	1	1	1	NOAEL
U	2	2	2	Adequate study design, but no reproductive endpoints examined.
Total AF	12	24	36	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	142	142	142	QCE = quantified critical endpoint
TRV	11.8	5.92	3.94	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	11.8	Test organism is in the same order and trophic level as the functional group members	M322
2	5.92	Test organism is in a different order and same trophic level from the functional group members	none
3	3.94	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M123, M210, M210A, M222, M422,M422A

COPC: **Zinc** CAS 68813-94-5

Test Organisms: Mallard (Herbivore, Order-Anseriformes)

Exposure Medium: Diet

Test Endpoint: LOAEL

Reference: Gasaway and Buss, 1972, "Zinc Toxicity in the Mallard Duck", *J. Wildl. Manage,* 36:1107-1117.

QCE: 207 mg/kg-day—(3000mg/kg food)*(0.0363kg/day)/(0.525 kg BW)

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	15 males and 15 females tested, no juveniles
Q_1	1	1	1	Endpoint ecologically relevant (mortality, BW, and blood chemistry)
Q_2	2	2	2	Subchronic duration
Q_3	2	2	2	LOAEL
U	1	1	1	High quality study, but no NOAEL dose was found, all doses were toxic
Total AF	8	16	24	$R * I * Q_1 * Q_2 * Q_3 * U$ = Total AF
QCE (mg/kg-day)	207	207	207	QCE = quantified critical endpoint
TRV	25.9	12.9	8.63	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	25.9	Test organism is in the same order and trophic level as the functional group members	AV142, AV143
2	12.9	Test organism is in a different order and same trophic level from the functional group members	AV121, AV122, AV132
3	8.63	Test organism is in a different order and trophic level from the functional group members	AV210, AV210A, AV221, AV222, AV222A, AV232, AV233, AV241, AV242, AV310, AV322, AV333, AV342, AV422, AV432, AV433, AV442

*Ingestion rate specified in article, converted to ounces/10 days to kg/day

**BW estimated by interpolation of values given in the Wildlife Exposures Handbook and an average of 77% weight loss(given in article). 682*0.77=525 g

Zinc (zinc oxide)

COPC: **Zinc (zinc oxide)** CAS 7440-66-6

Test Organisms: Rat (Omnivore, Order-Rodentia)

Exposure Medium: Diet

Test Endpoint: NOAEL

Reference: Schlicker, S.A. and D.H. Cox, 1968, "Maternal dietary zinc and development and zinc, iron and copper content of the rat fetus," Journal of Nutrition, 95:287-294.

ATSDR, Agency for Toxic Substance Disease Registry, 1988, Draft: Toxicological Profile for Zinc, December.

QCE: 170 mg/kg-day

Adjustment Factors (AF)				Justification for adjustment factor
R	1	2	3	R = 1 is AF for same order and trophic level R = 2 is AF for different order and same trophic level R = 3 is AF for different order and trophic level
I	2	2	2	Smaller number (60) of females tested.
Q_1	1	1	1	Ecologically relevant endpoint (developmental effects)
Q_2	1	1	1	Chronic duration (36 days)
Q_3	1	1	1	NOAEL
U	2	2	2	Good design, reproductive endpoints and sensitive life stage examined, only 2 doses tested.
Total AF	4	8	12	R * I * Q_1 * Q_2 * Q_3 * U = Total AF
QCE (mg/kg-day)	170	170	170	QCE = quantified critical endpoint
TRV	43	21	14	Toxicity Reference Value = QCE/Total AF

R Value	TRV (mg/kg-day)	Justification	Appropriate Functional Group
1	43	Test organism is in the same order and trophic level as the functional group members	none
2	21	Test organism is in a different order and same trophic level from the functional group members	M422, M422A
3	14	Test organism is in a different order and trophic level from the functional group members	M121, M122, M122A, M132, M210, M210A, M222, M322